



# Air Force Research Laboratory|AFRL

*Science and Technology for Tomorrow's Air and Space Force*



## Success Story

### LOW-SHOCK SEPARATION SYSTEM DRAMATICALLY REDUCES SATELLITE FAILURES



The shock of separation of satellites from the launch system (normally a rocket) causes many failures, requiring development of a satellite low-shock separation system. The Lightband system is 25% lighter, 50% smaller, 40% cheaper, and generates <5% of the shock of existing conventional pyrotechnic separation systems. The Lightband provides a capability that reduces on-orbit failures, reduces the cost of design and redesign, and reduces launch costs. This technology could save spacecraft programs several million dollars in life-cycle costs per spacecraft.



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## Accomplishment

Using technology explored under the Small Business Innovation Research (SBIR) program, the Space Vehicles Directorate successfully developed and transitioned the country's next-generation, small spacecraft separation system called the Lightband. Operating with limited SBIR funding, a directorate team developed, designed, tested, and successfully flew the world's first reusable, non-discrete point, low-shock, non-pyrotechnic separation system.

This Lightband system successfully separated the National Aeronautics and Space Administration's (NASA) Starshine-3 primary satellite from Lockheed Martin's Athena I launch vehicle on the first orbital launch out of Kodiak, Alaska. For the Starshine-3 spacecraft, the low-shock separation system reduced the shock-induced loading from 8,000 G-force (typical pyrotechnic separation system) to 300 g's.

## Background

During the past decade, NASA lost billions of dollars due to satellite malfunctions, resulting in total or partial mission failure. These malfunctions are often directly attributable to vibration loads during launch and satellite separation from the rocket.

Low-shock separation systems are an enabling technology for small (<100 kg) Department of Defense satellites and for the launching of fragile spacecraft components such as advanced optical systems. Small satellites are particularly susceptible to shock-related failure because of the close proximity of sensors and instruments to the shock source, necessitating a low-shock separation system.

The Air Force required a low-risk small satellite launch system that was compatible with existing systems. Due to the program's success, this separation system is baselined into AFRL's University Nanosatellite program, the Technology satellite of the 21st century, Experimental Small satellite-11, the Space and Missile Center's Space Test Satellite, Multiple Space Vehicle 05 (the first evolved expendable launch vehicle secondary payload adapter flight), the Naval Postgraduate School satellite, and the university's "CubeSat."

## Additional information

To receive more information about this or other activities in the Air Force Research Laboratory, contact TECH CONNECT, AFRL/XPTC, (800) 203-6451 and you will be directed to the appropriate laboratory expert. (03-VS-20)